

212/560

In the claims:

1. (currently amended) An apparatus adapted for removing gas bubbles from blood comprising:
an axially elongate shell defining a chamber;
an impeller disposed within the chamber;
a motor operably connected to the impeller,
a gas vent in fluid communication with the central axis of the shell,
a blood inlet port; and
a blood outlet port located at the radial periphery of said shell;
wherein the impeller is operable to rotate a volume of blood within the chamber about the central axis of the shell thus forcing air bubbles within the volume of blood to migrate radially inward in response to centrifugal forces imparted on the volume of blood by the rotation of said blood.
2. (Original) The apparatus of Claim 1 wherein said blood inlet port is positioned tangentially to said shell.
3. (Original) The apparatus of Claim 1 wherein said shell includes an axially elongate baffle interposed between the chamber and the gas vent.
4. (Original) The apparatus of Claim 1 wherein said motor is electrically driven.

212/560

5. (previously presented) The apparatus of Claim 1 wherein said motor and impeller are operable to rotate the impeller at a rate of approximately 100 to 10,000 RPM.
6. (Original) The apparatus of Claim 1 wherein said gas vent is connected to a gas pump.
7. (Original) The apparatus of Claim 1 wherein said blood outlet port comprises a screen or mesh type particulate filter.
8. (Original) The apparatus of Claim 1 wherein said blood outlet port is positioned tangentially to said shell.
9. (Original) The apparatus of Claim 1 wherein the interior surfaces of said shell are coated with anti-thrombogenic materials.
10. (Original) The apparatus of Claim 1 wherein said blood inlet port is located higher than said blood outlet port.
11. (Original) The apparatus of Claim 1 wherein said blood inlet port is located lower than said blood outlet port.
12. (Original) The apparatus of Claim 1 wherein said gas vent is located higher than both said blood inlet port and said blood outlet port.
13. (Original) The apparatus of Claim 1 wherein said impeller is magnetically coupled to said motor drive.
14. (Original) The apparatus of Claim 1 wherein said impeller comprises a plurality of vanes to spin the blood.

212/560

15. (Original) The apparatus of Claim 1 wherein said impeller comprises a smooth outer surface to spin the blood using viscous effects.

16. (Original) The apparatus of Claim 1 wherein said gas vent further comprises a gas trap.

17. (Withdrawn) A method for removing bubbles from blood comprising the steps of:

pumping blood into an axially elongate vessel,
actively spinning the blood to create a centrifugal force
on the blood, thereby collecting gas bubbles toward the
center of the axially elongate vessel, and
removing a portion of the blood from the axially elongate
vessel along the radial periphery of said vessel so as to
minimize the gas bubble content of the blood.

18. (Withdrawn) The method of Claim 17, which includes the step of passing the blood through a particulate filter.

19. (Withdrawn) The method of Claim 17, further comprising the step of:

spinning the blood at a rate of between 100 and 10,000 revolutions per minute.

20. (Withdrawn) An apparatus adapted for removing gas bubbles from blood comprising:

a blood filter comprising a chamber and an impeller adapted to rotate within the chamber,

212/560

a motor drive,

a clamping mechanism to permit attachment of said blood filter to said motor drive,

wherein said blood filter is operable to actively rotate the blood by the motion imparted by the impeller at speeds sufficient to cause gas bubbles to separate from the blood,

a vent in fluid communication with the chamber, whereby the separated gas bubbles exit the blood filter; and

an outlet port disposed on the radial periphery of the blood filter, whereby degassed blood exits the blood filter.

21. (Withdrawn) An system adapted for removing gas bubbles from blood, said system comprising:

a blood pump adapted for pumping blood;

a blood filter comprising a chamber characterized by a upper region, a lower region, a central axis, a radially central region and a radially peripheral region and an impeller adapted to rotate within the chamber,

means for rotating the impeller about the central axis;

an inlet port in fluid communication with the blood pump, said input port communicating with the chamber in the lower region and radially peripheral region thereof;

an outlet port communicating with the chamber in the upper region and radially peripheral of the blood filter;

212/560

a vent in fluid communication with the radially central region of the chamber.

22. (Withdrawn) The system of claim 21 further comprising:

a venous blood reservoir for collecting venous blood from a patient, and means for establishing fluid communication from the patient's venous system and the blood reservoir; and

a fluid conduit connecting the vent to the venous blood reservoir, whereby blood entrained in the gas stripped from the blood in the chamber may be recovered and replaced into the system upstream of the blood filter.

23. (Withdrawn) The system of claim 21 further comprising:

means for releasably attaching the chamber to the means for rotating the impeller about the central axis; whereby the chamber may be discarded after use and the means for rotating may be re-used.

24. (Currently Amended) An apparatus adapted for removing gas bubbles from blood comprising:

an axially elongate shell defining a chamber;

an impeller disposed within the chamber, wherein the impeller rotates about an axis concentric with the axis of the shell and the impeller is operable to rotate a volume of blood substantially filling the chamber about the axis of the shell;

a motor operably connected to the impeller to cause the impeller to rotate about its axis;

212/560

a gas vent in fluid communication with the central axis of the shell, wherein gas collected along the central axis of the shell is removed from said shell through the gas vent;

a blood inlet port operable to fill the chamber with blood;
and

a blood outlet port located at the radial periphery of said shell, wherein said blood outlet port is operable to drain blood from the chamber;

wherein the blood inlet port receives blood that has been drained from a patient's body and the blood outlet port delivers blood back to a patient, wherein the blood delivered back to the patient has had air bubbles removed primarily by centrifugal forces generated on the air bubbles by the rotating blood within the apparatus.

25. (previously presented) The apparatus of Claim 24 wherein the motor is magnetically coupled to the impeller, wherein rotation of the impeller is driven across the shell.
26. (previously presented) The apparatus of Claim 24 wherein the blood inlet port is operably connected to a cardiopulmonary bypass system.
27. (previously presented) The apparatus of Claim 24 wherein the blood outlet port is operably connected to a cardiopulmonary bypass system.
28. (previously presented) The apparatus of Claim 24 wherein the impeller actively spins the blood creating a centrifugal

212/560

force on the blood, thereby collecting gas bubbles toward the center of the axially elongate shell.

29. (previously presented) The apparatus of Claim 24 wherein a portion of the blood contained therein is removed through the blood outlet port located substantially along the radial periphery of said shell so as to minimize the gas bubble content of the blood at the blood outlet port.

30. (currently amended) An apparatus adapted for removing gas bubbles from blood comprising:

an axially elongate chamber comprising a shell;

means for adding blood to the chamber;

means for impelling rotation to the blood within the chamber about the axis of the chamber, whereby gas in the blood is released and collected within the chamber near its central axis due to centrifugal effects generated by the rotating blood;

means for venting the gas bubbles collected within the chamber; and

means for removing blood from the chamber, whereby at least a portion of the gas bubbles have been removed from the blood.